WE CLAIM:

1. A rotor comprising:

at least a first rotor;

an air foil bearing supporting a first end of said first rotor; and

a hydrodynamic carbon bearing/seal providing additional support to said first rotor and sealing a bearing compartment of said air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said air foil bearing without said hydrodynamic carbon bearing/seal.

2. The rotor according to claim 1, wherein said hydrodynamic carbon bearing/seal is designed integrally with said air foil bearing.

3. The rotor according to claim 2, further comprising:

an electrical machine having an electrical machine bearing therein reacting either a thrust load or radial load or both; and

said electrical machine bearing supporting a second, opposite end of said first rotor.

4. The rotor according to claim 3, wherein said electrical machine bearing includes an electrical machine air foil bearing and an electrical machine hydrodynamic carbon bearing/seal providing additional axial and radial support to said first rotor and sealing a bearing compartment of said electrical machine air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said electrical machine air foil bearing without said electrical machine hydrodynamic carbon bearing/seal.

5. The rotor according to claim 3, wherein said electrical machine is an axial gap electric machine.

6. The rotor according to claim 4, wherein said electrical machine hydrodynamic carbon bearing/seal is designed integrally with said electrical machine air foil bearing.

7. The rotor according to claim 1 wherein said at least a first rotor includes a first rotor and a second rotor further comprising:

a second air foil bearing supporting a first end of said second rotor; and

a second hydrodynamic carbon bearing/seal providing additional support to said second rotor and sealing a bearing compartment of said second air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said second air foil bearing without said second hydrodynamic carbon bearing/seal.

8. The rotor according to claim 7, wherein said second hydrodynamic seal is designed integrally with said second air foil bearing.

9. The rotor according to claim 8, further comprising:

a second electrical machine having a second electrical machine bearing therein reacting either a thrust load (an axial gap electrical machine) or radial load or both; and

said second electrical machine bearing supporting a second, opposite end of said second rotor.

10. The rotor according to claim 9, wherein said second electrical machine bearing includes a second electrical machine air foil bearing and a second electrical machine hydrodynamic carbon bearing/seal providing additional axial and radial support to said first rotor and sealing a bearing compartment of said second electrical machine air foil bearing, thereby allowing

an increased internal operating pressure, and hence, increased capacity, as compared to said second electrical machine air foil bearing without said second electrical machine hydrodynamic carbon bearing/seal.

11. The rotor according to claim 10, wherein said second electrical machine hydrodynamic carbon bearing/seal is designed integrally with said second electrical machine air foil bearing.

12. The rotor according to claim 1, further comprising:

a magnetic thrust bearing supporting said first rotor; and

a thrust bearing hydrodynamic carbon bearing/seal sealing said magnetic thrust bearing and providing additional support of said first rotor.

13. The rotor according to claim 7, further comprising:

a second magnetic thrust bearing supporting said second rotor; and

a second thrust bearing hydrodynamic carbon bearing/seal sealing said second magnetic thrust bearing and providing additional support of said second rotor.

14. The rotor according to claim 3, wherein said electrical machine is a combination starter/generator in a single spool engine configuration or a generator when said first rotor is a low pressure rotor for a two spool engine configuration.

15. The rotor according to claim 9, wherein said second electrical machine is a starter.

16. The rotor according to claim 1, wherein said hydrodynamic carbon bearing/seal comprises:

a circular U-shaped substrate;

a plurality of carbon segments arranged circumferentially in said substrate;

an axial preload spring providing a resilient force on each of said plurality of carbon segments in an axial direction;

a radial spring providing a resilient force on each of said plurality of carbon segments in a radial direction, pressing said plurality of carbon segments into contact with said first rotor when said rotor is in a non-operational state; and

a rotor contacting face of each of said plurality of carbon segments designed to create a force opposite that of said radial spring when said first rotor is rotated, thereby creating said hydrodynamic carbon bearing/seal.

17. A rotor having its load shared among a plurality of bearings comprising:

a first rotor;

an air foil bearing supporting a first end of said first rotor;

a hydrodynamic carbon bearing/seal providing additional support to said first rotor and sealing a bearing compartment of said air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said air foil bearing without said hydrodynamic carbon bearing/seal;

said hydrodynamic carbon bearing/seal being designed integrally with said air foil bearing;

an electrical machine having an electrical machine bearing therein;

said electrical machine bearing supporting a second, opposite end of said first rotor;

said electrical machine bearing includes an electrical machine air foil bearing and an electrical machine hydrodynamic carbon bearing/seal providing additional axial and radial support to said first rotor and sealing a bearing compartment of said electrical machine air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said electrical machine air foil bearing without said electrical machine hydrodynamic carbon bearing/seal; and

said electrical machine hydrodynamic carbon bearing/seal being designed integrally with said electrical machine air foil bearing.

18. The rotor according to claim 17, further comprising:

a second rotor;

a second air foil bearing supporting a first end of said second rotor; and

a second hydrodynamic carbon bearing/seal providing additional support to said second rotor and sealing a bearing compartment of said second air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said second air foil bearing without said second hydrodynamic carbon bearing/seal; wherein

said second hydrodynamic seal is designed integrally with said second air foil bearing.

19. The rotor according to claim 18, further comprising:

a second electrical machine having a second electrical machine bearing therein; wherein

said second electrical machine bearing supporting a second, opposite end of said second rotor;

said second electrical machine bearing includes a second electrical machine air foil bearing and a second electrical machine hydrodynamic carbon bearing/seal providing additional axial and radial support

to said first rotor and sealing a bearing compartment of said second electrical machine air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said second electrical machine air foil bearing without said second electrical machine hydrodynamic carbon bearing/seal; and

said second electrical machine hydrodynamic carbon bearing/seal is designed integrally with said second electrical machine air foil bearing.

20. The rotor according to claim 19, further comprising:

a magnetic thrust bearing supporting said first rotor; and

a thrust bearing hydrodynamic carbon bearing/seal sealing said magnetic thrust bearing and providing additional support of said first rotor.

21. The rotor according to claim 20, further comprising:

a second magnetic thrust bearing supporting said second rotor; and

a second thrust bearing hydrodynamic carbon bearing/seal sealing said second magnetic thrust bearing and providing additional support of said second rotor.

22. A rotor for a two spool engine configuration of an aircraft, comprising:

a first rotor;

a second rotor;

an air foil bearing supporting a first end of said first rotor;

a second air foil bearing supporting a first end of said second rotor;

a first hydrodynamic carbon bearing/seal providing additional support to said first rotor and sealing a bearing compartment of said air foil bearing, thereby allowing an increased internal operating pressure, and hence,

increased capacity, as compared to said air foil bearing without said hydrodynamic carbon bearing/seal;

a second hydrodynamic carbon bearing/seal providing additional support to said second rotor and sealing a bearing compartment of said second air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said second air foil bearing without said second hydrodynamic carbon bearing/seal;

said first hydrodynamic carbon bearing/seal and said second hydrodynamic carbon bearing/seal being designed integrally with said air foil bearing;

a first electrical machine having an electrical machine bearing therein, said second electrical machine bearing supporting a second, opposite end of said first rotor;

a second electrical machine having an electrical machine bearing therein, said second electrical machine bearing supporting a second, opposite end of said second rotor;

said first and second electrical machine bearings each include an electrical machine air foil bearing and an electrical machine hydrodynamic carbon bearing/seal providing additional axial and radial support to said first and second rotor and sealing a bearing compartment of said first and second electrical machine air foil bearing, thereby allowing an increased internal operating pressure, and hence, increased capacity, as compared to said first and second electrical machine air foil bearing without said first and second electrical machine hydrodynamic carbon bearing/seal; and

said first and second electrical machine hydrodynamic carbon bearing/seals being designed integrally with said first and second electrical machine air foil bearings.

23. The rotor according to claim 22, further comprising:

a first magnetic thrust bearing supporting said first rotor;

a second magnetic thrust bearing supporting said second rotor;

a first thrust bearing hydrodynamic carbon bearing/seal sealing said first magnetic thrust bearing and providing additional support of said first rotor; and

a second thrust bearing hydrodynamic carbon bearing/seal sealing said second magnetic thrust bearing and providing additional support of said second rotor.

24. The rotor according to claim 22, wherein:

said first electrical machine is a generator; and

said second electrical machine is a starter.

25. The rotor according to claim 22, wherein each of said hydrodynamic carbon bearing/seal comprises:

a circular U-shaped substrate;

a plurality of carbon segments arranged circumferentially in said substrate;

an axial preload spring providing a resilient force on each of said plurality of carbon segments in an axial direction;

a radial spring providing a resilient force on each of said plurality of carbon segments in a radial direction, pressing said plurality of carbon segments into contact with said first rotor when said rotor is in a non-operational state; and

a rotor contacting face of each of said plurality of carbon segments designed to create a force opposite that of said radial spring when said first rotor is rotated, thereby creating said hydrodynamic carbon bearing/seal.

26. A method for sharing the load of a rotor of an aircraft gas turbine engine, comprising:

supporting a first end of a first rotor by a first air foil bearing;

sealing a bearing compartment of said first air foil bearing with a first hydrodynamic carbon bearing/seal, said first hydrodynamic carbon bearing/seal providing additional support for said first rotor; and

supporting a second, opposite end of said first rotor by a first electrical machine bearing from a first electrical machine, said first electrical machine bearing includes a first electrical machine air foil bearing and a first electrical machine hydrodynamic carbon bearing/seal providing additional support to said first rotor and sealing a bearing compartment of said first electrical machine air foil bearing.

27. The method according to claim 26, further comprising:

supporting a first end of a second rotor by a second air foil bearing;

sealing a bearing compartment of said second air foil bearing with a second hydrodynamic carbon bearing/seal, said second hydrodynamic carbon bearing/seal providing additional support for said second rotor; and

supporting a second, opposite end of said second rotor by a second electrical machine bearing from a second electrical machine, said second electrical machine bearing includes a second electrical machine air foil bearing and a second electrical machine hydrodynamic carbon bearing/seal providing additional support to said second rotor and sealing a bearing compartment of said second electrical machine air foil bearing.

28. The method according to claim 27, further comprising:

supporting said first rotor with a first magnetic thrust bearing;

supporting said second rotor with a second magnetic thrust bearing;

sealing said first magnetic thrust bearing with a first thrust bearing hydrodynamic carbon bearing/seal, thereby providing additional support of said first rotor; and

sealing said second magnetic thrust bearing with a second thrust bearing hydrodynamic carbon bearing/seal, thereby providing additional support of said second rotor.

29. A hydrodynamic carbon bearing/seal comprising:

a circular U-shaped substrate;

a plurality of carbon segments arranged circumferentially in said substrate;

an axial preload spring providing a resilient force on each of said plurality of carbon segments in an axial direction;

a radial spring providing a resilient force on each of said plurality of carbon segments in a radial direction, pressing said plurality of carbon segments into contact with said first rotor when said rotor is in a non-operational state; and

a rotor contacting face of each of said plurality of carbon segments designed to create a force opposite that of said radial spring when said first rotor is rotated, thereby creating said hydrodynamic carbon bearing/seal.

30. The hydrodynamic carbon bearing/seal according to claim 29, further comprising:

a plurality of notches in said plurality of carbon bearing segments;

a corresponding plurality of substrate notches in said substrate; and

anti-rotation pins having a first end fitting in said plurality of notches and a second end fitting in said corresponding plurality of substrate

notches, thereby preventing rotation of said plurality of carbon bearing segments without the corresponding rotation of said substrate.